

Amendments to and Listing of Claims

Please amend claims 1–6, 10, 11, 14, 15, 18–26. Please add claims 27 and 28.
This listing of claims will replace all prior versions and listings of claims in the application:

1. (Currently Amended) A swirl chamber used in association with a combustion chamber for diesel engines, wherein the combustion chamber is defined by a piston, a cylinder, and a cylinder head, the swirl chamber comprising:

a mouthpiece fitted in a hole of the cylinder head, the hole having a bottom-open recess, and the mouthpiece including a top-open recess, the bottom-open recess and the top-open recess constituting a space intended for the swirl chamber;

a main nozzle hole produced through a base wall of the mouthpiece to effect communication between the combustion chamber and the swirl chamber; and

a pair of sub-nozzle holes which are separated from the main nozzle hole, produced through the base wall of the mouthpiece, the holes being positioned ~~symmetrically~~ on opposite sides of the central axis of the main nozzle hole when the mouthpiece is seen from just above;

wherein each of the sub-nozzle holes is arranged to pass inside a hypothetical ~~first~~ sphere depicted around a center of an upper circle of the top-open recess having a radius of 70% of ~~that of a hypothetical second circle depicted around the center~~ a diameter of the upper circle of the top-open recess.

2. (Currently Amended) The swirl chamber as recited in claim 1, wherein the ~~first~~ sphere has a radius of 60% of ~~that~~ the diameter of the second upper circle of the top-open recess.

3. (Currently Amended) The swirl chamber as recited in claim 1, wherein the ~~first~~ sphere has a radius of 50% of ~~that~~ the diameter of the second upper circle of the top-open recess.

4. (Currently Amended) The swirl chamber as recited in claim ~~3~~, 1, wherein each of the sub-nozzle holes is positioned such that its respective center ~~coincides with~~ overlaps the ~~first~~

~~circle~~ sphere having a radius of 50% of ~~that of the second circle~~ the diameter of the upper circle of the top-open recess when the mouthpiece is seen from just above.

5. (Currently Amended) The swirl chamber as recited in claim 1, wherein each of the sub-nozzle holes is positioned such that its central axis passes within an angular range of 0^0 to 30^0 away from a reference line ~~supposed to pass axially through the sub-nozzle hole.~~ extending just upwards when the mouthpiece is seen from a just lateral side in a direction perpendicular to a center axis of the main nozzle hole.

6. (Currently Amended) The swirl chamber as recited in claim 5, ~~wherein the angular range is 0^0 to 15^0 .~~ 1, wherein each of the sub-nozzle holes is positioned such that its central axis passes within an angular range of 0^0 to 15^0 away from a reference line extending just upwards when the mouthpiece is seen in an immediately rearward direction with the main nozzle hole arranged to appear forwardly.

7. (Original) The swirl chamber as recited in claim 1, wherein the total area of the open ends of the sub-nozzle holes is in the range of 3% to 15% of that of the main nozzle hole.

8. (Original) The swirl chamber as recited in claim 7, wherein the total area is in the range of 4% to 10% of that of the main nozzle hole.

9. (Original) The swirl chamber as recited in claim 1, wherein the main nozzle hole comprises a main groove and two side grooves each communicatively continuous to the main groove through banks.

10. (Currently Amended) The swirl chamber as recited in claim 9, wherein the side grooves are positioned such that their central axes exist rearward of that of the main groove. when the mouthpiece is seen from a just lateral side in a direction perpendicular to a center axis of the main nozzle hole.

11. (Currently Amended) The swirl chamber as recited in claim 10, wherein each of

the side grooves has its central axis inclined at a smaller angle than an angle at which the central axis of the main groove is inclined with respect to the level of the base wall of the mouthpiece: when the mouthpiece is seen from a just lateral side in a direction perpendicular to a center axis of the main nozzle hole.

12. (Original) The swirl chamber as recited in claim 11, wherein the side grooves are positioned such that the distance between them diminishes toward their forward ends.

13. (Original) The swirl chamber as recited in claim 9, wherein each of the side grooves has a progressively diminishing cross-sectional area toward its forward end.

14. (Currently Amended) The swirl chamber as recited in claim 9, wherein when the mouthpiece is seen from just above, each of the side grooves is positioned such that its central axis is arranged at a position retreated from an upper opening of every sub-nozzle hole in parallel to, and rearward of, the central center axis of the main groove nozzle hole and immediately rearwards thereof.

15. (Currently Amended) The swirl chamber as recited in claim 1, wherein each of the sub-nozzle holes is positioned such that its central axis ~~extends~~passes within an angular range of 0° to 30° away from a reference line ~~supposed to pass axially through the sub-nozzle hole~~extending just upwards when the mouthpiece is seen from a just lateral side in a direction perpendicular to a center axis of the main nozzle hole and,

the angular range is 0° to 15° away from the reference line extending just upwards when the mouthpiece is seen in an immediately rearward direction with the main nozzle hole arranged to appear forwardly.

16. (Original) The swirl chamber as recited in claim 15, wherein the total area of the open ends of the sub-nozzle holes is in the range of 3% to 15% of that of the main nozzle hole.

17. (Original) he swirl chamber as recited in claim 15, wherein the main nozzle hole

comprises a main groove and two side grooves each communicatively continuous to the main groove through banks.

18. (Currently Amended) The swirl chamber as recited in claim 17, wherein when the mouthpiece is seen from just above, each of the side grooves is positioned such that its central axis is arranged at a position retreated from an upper opening of every sub-nozzle hole in parallel to, and rearward of, the central center axis of the main nozzle hole and immediately rearwards thereof.

19. (Currently Amended) The swirl chamber as recited in claim 1, wherein the sub-nozzle holes are positioned such that their central axes are upright on the base wall of the mouthpiece- when the mouthpiece is seen from a just lateral side in a direction perpendicular to a center axis of the main nozzle hole.

20. (Currently Amended) The swirl chamber as recited in claim ~~19~~1, wherein the ~~total area of the open ends of the sub-nozzle holes is in the range of 3% to 15% of that of the main nozzle hole.~~ sub-nozzle holes are positioned such that their central axes are upright on the base wall of the mouthpiece when the mouthpiece is seen from an immediately rearward direction with the main nozzle hole arranged to appear forwardly.

21. (Currently Amended) The swirl chamber as recited in claim ~~[[19]]~~ 1, wherein the ~~main nozzle hole comprises a main groove and two side grooves each communicatively continuous to the main groove through banks.~~ sub-nozzle holes are positioned such that their central axes are upright on the base wall of the mouthpiece when the mouthpiece is seen from a just lateral side in a direction perpendicular to a center axis of the main nozzle hole, and

the sub-nozzle holes are positioned such that their central axes are upright on the base wall of the mouthpiece when the mouthpiece is seen in an immediately rearward direction with the main nozzle hole arranged to appear forwardly.

22. (Currently Amended) The swirl chamber as recited in claim 21, wherein ~~each of~~

~~the side grooves is positioned such that its central axis is in parallel to, and rearward of, the central axis of the main groove.~~ the total area of the open ends of the sub-nozzle holes is in the range of 3% to 15% of that of the main nozzle hole.

23. (Currently Amended) The swirl chamber as recited in claim 9, ~~wherein each of the side grooves is forwardly inclined at an angle of elevation from a main combustion chamber to the swirl chamber~~21, wherein the main nozzle hole comprises a main groove and two side grooves each communicatively continuous to the main groove through banks.

24. (Currently Amended) The swirl chamber as recited in claim 9,23, wherein each of the side grooves is positioned such that its central axis is in parallel to, and rearward inclined at an angle of elevation from a main combustion chamber to the swirl chamber.~~of, the central axis of the main groove.~~

25. (Currently Amended) The swirl chamber as recited in claim 1, wherein ~~the sub-nozzle holes are positioned such that the distance between them becomes narrower toward their top open ends~~ each of the side grooves is forwardly inclined at an angle of elevation from a main combustion chamber to the swirl chamber.

26. (Currently Amended) The swirl chamber as recited in claim 1, wherein ~~the sub-nozzle holes are positioned such that the distance between them becomes wider toward their top open ends~~ each of the side grooves is rearward inclined at an angle of elevation from a main combustion chamber to the swirl chamber.

27. (New) The swirl chamber as recited in claim 1, wherein the sub-nozzle holes are positioned such that the distance between them becomes narrower toward their top open ends.

28. (New) The swirl chamber as recited in claim 1, wherein the sub-nozzle holes are positioned such that the distance between them becomes wider toward their top open ends.